



Rocky Mountain
Remediation Services, L L C
protecting the environment

PROCEDURE

WATER LEVEL MEASUREMENTS IN WELLS AND PIEZOMETERS

Procedure No RMRS/OPS PRO 105

Revision 0

Date effective 12/28/98

APPROVED

Manager Water Operations Waste Operations Division

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USE CATEGORY 2

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1 0 PURPOSE

This document contains guidelines for measuring water levels in wells and piezometers at the Rocky Flats Environmental Technology Site (RFETS). Water level data can be obtained from wells and piezometers or from surface water manifestations of the groundwater systems such as springs, lakes, and streams.

2 0 SCOPE

This document applies to all Rocky Mountain Remediation Services (RMRS) personnel and subcontractors conducting groundwater related work at the RFETS. This document, which constitutes a Standard Operating Procedure (SOP), describes various acceptable methods for measuring water levels in wells and piezometers that will meet regulatory guidelines of accuracy. This document supercedes groundwater SOP GW 01.

3 0 REQUIREMENTS

The following sections identify the personnel qualifications and equipment for measuring water levels in wells and piezometers.

3 1 Personnel Qualifications

Personnel performing water level measurement procedures are required to have completed the initial 40-hour OSHA classroom training that meets the Department of Labor requirements 29 CFR 1910.120(e)(3)(i) and must maintain a current training status by completing the appropriate annual 8 hour OSHA refresher courses. Personnel must also have read and signed the appropriate Health and Safety Plan(s). Prior to engaging in water level measurement activities, personnel must have a complete understanding of the procedures described within this SOP and, if necessary, will be given specific training regarding these procedures by other personnel experienced in the methods described within this SOP.

Only qualified personnel will be allowed to perform these procedures. Required qualifications vary depending on the activity to be performed. The subcontractor's project manager will document personnel qualifications related to this procedure in the subcontractor's project QA files.

3 2 Equipment

The following is a list of basic equipment typically required when measuring water levels. Additional equipment may be required in less typical applications and will be specified in the project specific work plan or other appropriate document.

- Groundwater Level Measurements/Calculations forms (Form PRO 105A)
- Electronic water level sounder
- Manometer and appropriate polyethylene or polytetrafluoroethylene (PTFE e.g. Teflon™) tubing
- Interface probe (If required)
- Graduated steel tape and carpenter's chalk (if required)
- Decontamination equipment and supplies
- Health and safety equipment and supplies (organic vapor monitor and personal protective equipment)

In most water level measuring activities at RFETS, an electronic water level sounder is preferred. However, some small diameter well points exist which require the use of a manometer, and some wells may contain immiscible

lavers that will require an interface probe and/or graduated steel tape and chalk. Some wells may contain down hole pressure transducers that will require additional equipment such as a portable computer, diskettes, and the manufacturer's instructions for downloading data, and form PRO 105B.

4.0 INSTRUCTIONS

Field measurements typically include depth to standing water and the total depth of the well. Water level measurements will be recorded to the nearest 0.01 foot as specified by the RCRA Groundwater Monitoring Technical Enforcement Guidance Document.

Each well will have a permanent, easily identified measuring point (MP) from which the water level measurement will be made. For the purpose of this SOP, the MP is defined as a surveyed point notched into the northern edge of the inner polyvinyl chloride (PVC) or stainless steel casing. If an MP is not established in a well, the water level will be measured from the northern edge of the inner casing, and the point marked by notching with a file. The addition of the permanent MP will be noted on form PRO 105A.

In addition, the following conditions must be considered in order to obtain acceptably accurate groundwater level measurements:

- Water levels in wells and piezometers will be allowed to stabilize for a minimum of 24 hours following installation or development before the water level is measured. Water levels require varying time periods to reach static conditions in new wells; therefore, the date and time of well construction, and the date, time, and reading of the initial water level measurement will be noted.
- Water levels should be measured before initiating purging and sampling activities.
- At RFETS, multiple sampling events may occasionally occur over a few days. For wells that recharge slowly, the water level measured at such a well may not reflect static water conditions. In order to prevent a misinterpretation of static water levels in these cases, the date of the last sampling or well purging event will be documented in the water level measurement database.
- Static water levels will usually be measured with electronic sounders. If the well or piezometer is too small in diameter to accept an electronic sounder, a manometer and appropriately sized tubing will be used. If non-aqueous phase liquids (NAPLs) are potentially present, an interface probe will be used. In some cases, a graduated steel tape and carpenter's chalk may be preferable to an interface probe.
- Water level measurements that show the water level to be within the well sump will be considered technically dry for purposes of recording water level information.

4.1 Surveying the Measuring Point

Each well must have a permanent, easily identified, notched MP on the north edge of the inner PVC well casing. The elevation of the MP should preferably be established by a licensed surveyor, and should be referenced to an established benchmark. However, depending upon the purpose and location of some wells, the coordinates of the wells and the elevations of their respective MP's may be established by use of Global Positioning System (GPS) technology. In this case, the elevation will be established to the nearest foot. For consistency, water level measurements must be referenced to the same datum or elevation. The MP is surveyed with reference to the land

surface datum (LSD) and all water levels and total depth measurements are converted to elevations expressed as mean sea level (MSL)

A reference point (RP) for water level measurements is an additional datum elevation established from a permanent benchmark and surveyed by a licensed surveyor. The RP is usually located on the top of the outer steel casing of a well and is used as a backup to the MP. If the MP is disturbed or destroyed, the RP will be used to establish a new MP.

4.2 Using an Organic Vapor Monitor

Prior to measuring the water level in any well or piezometer, an organic vapor monitor (OVM) or accepted substitute (as defined by the project Health and Safety Plan) will be used to measure the levels of organic vapors in background, well bore, and breathing zone air. Operation of the OVM shall be in accordance with SOP FO 15 Photoionization Detectors (PIDs) and Flame Ionization Detectors (FIDs).

- The background air will be monitored in the vicinity of the well and working area before the well cap is removed. The effects of any potential sources of organic vapors, such as operating generators, vehicles, or the like, will be minimized as much as is practicable (e.g., a vehicle will be turned off or parked downwind from where activities are taking place). The presence of potential sources of organic vapors that are beyond the control of water level measurement personnel will be noted on form PRO 105A. The level of organic vapors in background air will be recorded on form PRO 105A.
- The well cap(s) will be removed and the tip of the OVM placed within the opening of the inner well casing to measure the level of organic vapors within the well bore. The results of this measurement will be recorded on form PRO 105A.
- Finally, the level of organic vapors in the breathing zone will be measured and recorded on form PRO 105A.

4.3 Instruments and Associated Water Level Measurement Techniques

Water level measurement instruments are used to determine the water level in boreholes, wells, piezometers, and some accessible subsurface structures. Measurements may be made with a number of different devices and procedures. Outside power sources are not generally required to operate most instruments. However, some will require that batteries be replaced or recharged periodically.

The following subsections describe the use of electronic water level sounders, the use of a manometer to measure water levels in small diameter well points, the use of an interface probe in the determination of immiscible layers, and the use of a graduated steel tape to measure water levels and total depths of wells.

Electronic water level sounders are the preferred water level measuring instruments at the RFETS. Typically, a steel tape will only be used for measuring the total depth of a well when LNAPLs are present. Using a steel tape under these conditions will help ensure that the interface probe and other electronic water level measuring devices do not become grossly contaminated, and thereby helps to prevent cross-contamination.

Electric Water Level Sounder

Typically, an electronic water level sounder marked to 0.01 foot intervals will be used to measure groundwater levels and total depths of wells at the RFETS. Before lowering the electronic sounder probe into the well, the

circuitry shall be checked by pressing the test button if the unit is so equipped, or by dipping the probe in clean water. If the unit is working properly the results of either test should be an audible tone. The probe will be lowered slowly into the well minimizing wall contact, until contact with the water surface is indicated. The individual measuring the water level shall perform at least two measurements that agree within 0.01 foot. If the two measurements do not agree within 0.01 foot, this individual shall continue to measure until two consecutive readings agree within 0.01 foot. If difficulties or inconsistencies persist, a second person shall repeat this process. Measurement shall continue until the values obtained by the two individuals agree within 0.05 foot. An average of the reproducible readings shall be used to determine the water level. Record and average the two readings that agree within 0.05 foot on form PRO 105A. The difficulties or inconsistencies also will be recorded on form PRO 105A as they may indicate the presence of NAPLs, damage to the water level sounder or other problems with the well.

Electronic sounders are recommended for measuring the depth to water in wells that are being pumped because sounders generally do not require removal from the well for each reading. However, if oil is present in the well, if water is cascading into the well, or if the water surface is turbulent, measuring water level with an electronic sounder may be difficult. Oil not only insulates the contacts of the probe, but it will also give an erroneous reading if there is a considerable thickness of oil. As noted previously and discussed in Subsection 4.3.4, if LNAPL is present a steel tape shall be utilized for measuring the total depth to the bottom of the well.

4.3.2 *Measuring Water Levels in Well Points*

A manometer may be required to measure the water level in well points because well points are often of too small a diameter to accept the probe and tape of a water level sounder. Before using a manometer, check the unit to be sure it is in working order. The manometer should be able to read 0.1 inches of water. Measure water levels as follows:

- Attach an appropriate length of appropriately sized polyethylene or PTFE (Teflon™) tubing to the manometer.
- Using the adjustment knob, zero the display reading.
- Insert the tubing into the well point tubing while watching the manometer. When a change in the manometer reading is observed, mark a point on the inserted tube.
- Withdraw the inserted tubing and measure its length (to the nearest 0.01-foot) from the down-hole end to the marked point. Be sure not to stretch the tubing during this measurement.
- Record the required information on form PRO 105A.

4.3.3 *Immiscible Layers and Use of an Interface Probe*

There are locations at RFETS that have observable immiscible layers in the ground water. These are currently limited to very small areas within the Industrial Area. Because the potential exists for the presence of immiscible organic compounds at these or similar locations, procedures have been established to detect the presence of these compounds and to sample them when present.

The first step is to determine whether there is a positive response on the OVM when its tip is positioned in the well bore. If the response is positive, the next step is to determine the presence and thickness of any NAPLs by use of an interface probe. In areas where the potential exists for NAPLs, an interface probe will be used to measure water levels. If groundwater samples are to be collected, the interface probe will be used in each well prior to each sampling event.

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- The manufacturer's instructions shall be followed when using the interface probe. The probe shall be sufficiently precise to measure water and NAPL levels to the nearest 0.01 foot.
 - The accuracy of repeated measurements must agree within 0.05 foot and shall be measured from the MP on the inner well casing.
 - The probe will be lowered very slowly so as to minimize disturbance of any layers of NAPL that may be present, and to limit penetration of any NAPL layers so as to ease decontamination of the probe. When lowering the probe, care will be taken to minimize rubbing of the tape against the well casing.
 - Typically, the interface probe will produce different sounds to distinguish between aqueous and non aqueous organic layers. Depth to aqueous or non aqueous phases will be recorded to the nearest 0.01 foot, measured from the MP on the inner well casing.

If LNAPLs are not present, the interface probe may be used to determine the presence and thickness of DNAPL layers and the total depth of the well.

- The interface probe will be slowly raised and lowered to pinpoint the depth that the appropriate indicator tone is reproducibly obtained. This will be done slowly and with care so as to minimize disruption of any NAPL layers.
- Measurements from three consecutive readings will be taken by two individuals and must not differ more than ± 0.05 foot or three more readings must be taken.
- An average of the reproducible readings will be used to determine the water or NAPL level. The results of all readings will be recorded on form PRO 105A.

Once the level has been determined and recorded, the probe will be carefully retrieved to ensure minimal rubbing of the tape against the inside well casing. The probe and tape will be decontaminated between use at each well following procedures given in Section 4.4 and SOP OPS PRO 127 General Equipment Decontamination.

Due to the difficulty in decontaminating the interface probe after it has passed through a non aqueous organic phase, if LNAPLs are present the interface probe will not be used to check for DNAPLs or to measure the total depth of the well. Instead, fluid will be collected to check for DNAPL and a graduated steel tape and carpenter's chalk will be used to measure the total depth as described in Section 4.3.4.

Wells containing LNAPLs shall be checked for the presence of DNAPLs by very slowly lowering a purge pump or pump tubing to the bottom of the well and collecting the first purge water from the bottom of the well in a one liter colorless glass container. The container will be initially checked with an organic vapor analyzer (OVA) for compared background readings. The liquid shall be allowed to stand for 15 minutes and visually observed for the presence of separate phases. If no DNAPLs have separated out of the solution after 15 minutes, the well shall be presumed free of DNAPLs.

If either LNAPLs or DNAPLs are detected, the well will be sampled for these phases as described in SOP OPS PRO 113 Groundwater Sampling if requested by the project specific work plan.

4.3.4 *Graduated Steel Tape*

The use of graduated steel tapes will normally be limited to determination of the total well depth of wells containing LNAPLs. A slender stainless steel weight will be attached to the end of the tape to create tautness and to permit a feel for obstructions and for the bottom of the well. The weight will be attached using wire rivets or other method that does not have the potential for contributing contaminants to the well. The tape will be lowered to the bottom of the well and the total depth will be read off the tape at the MP on the inner well casing.

The graduated steel tape method is considered accurate for measuring the water level in nonflowing wells (National Handbook of Recommended Methods for Water-Data Acquisition, 1977, pp 2-8) but will not be used for this purpose except in unusual circumstances as instructed by the subcontractor's project manager. If used to measure the water level, available well construction and prior water level data should be consulted first. After determining what length of tape may be submerged in the water within the well, use the carpenter's chalk to coat the tape from its down-hole end to a point a few feet above what would be a high water level for that well. The coated end shall be lowered down the well, taking care to minimize contact with condensation on the interior surfaces of the well, until the end is resting on the bottom of the well. The total depth (relative to the MP) shall then be recorded and the tape shall be withdrawn, again minimizing contact with the walls of the well. The water level is marked by a water line in the chalk. The water level below MP is calculated by subtracting the wetted length of tape from the total depth measured with the tape.

Before and after each well measurement, that part of the tape measure that extends down the well will be decontaminated. Decontamination procedures are discussed in Subsection 4.5 of this SOP Decontamination and in SOP PRO 127 General Equipment Decontamination.

4.4 Down-Hole Water Level Pressure Transducer

Water levels may be measured on a continuous basis through the use of a probe that is installed below the water level in a well. The probe contains a pressure transducer attached to a network of cables and tubing. The transducer measures pressure changes that result from changes in the volume of water (the head) above the probe. The cables and tubing may perform such functions as positioning the probe at the desired depth, relaying transducer data to a data logger and venting the probe so that fluctuations in barometric pressure are not recorded as changes in the water level. Because water level is derived from pressure changes detected by the transducer, only vented water level pressure transducer probes will be used at RFETS.

The data logger may be a separate, stand-alone unit that may be placed on the ground next to the well. It may also be contained within the probe, and feature a data transfer (downloading) cable that extends from the probe to the top of the well casing, or it may be stationed within the top of the well casing. Accumulated data are periodically downloaded from the data logger onto a portable computer.

4.4.1 *Preparation*

If the down-hole water level pressure transducer probe is to be installed in a well for long term water level monitoring, it may be advantageous to assemble the components to fit the individual well to be studied. Custom fitting will typically be performed by the manufacturer but at times may be performed by RMRS or subcontractor personnel. In most cases this requires cutting the assorted cables and tubing to lengths that, when assembled, allow the probe to be suspended at a depth below the lowest anticipated water level or at the bottom of the well. Personnel performing these activities will be careful not to twist, kink, or otherwise damage cables and tubing.

A variety of diaphragms with associated pressure ranges are typically available for the pressure transducer. A diaphragm with a low pressure rating allows the unit to be used in shallow water settings and higher pressure ratings allow the unit to be used in deeper water settings. Using the wrong diaphragm may result in poor resolution or faulty data.

The manufacturer's instructions shall be followed during all assembly and modification activities. If the unit is being modified by the manufacturer to fit a particular well, care will be taken to ensure that all depth and head (water column within the well) information reported to the manufacturer are correct.

Prior to installing a probe in a well: (1) the desiccant in the unit (if applicable) will be checked to ensure that it is fresh; (2) All communications between the probe, data logger, and downloading computer will be checked to ensure that they are functioning properly; (3) The data logger shall be programmed to collect and store the required data at the desired frequency and in the proper storage location; and (4) the unit's internal clock and calendar will be set.

The power source for the data logger and the amount of available memory on the logger will be checked to ensure they are adequate. The probe cables and tubing, connectors, and other down hole components will be decontaminated according to SOP PRO 127 General Equipment Decontamination or, if these instructions are not appropriate, the manufacturer's instructions. Be sure not to twist, kink, or otherwise damage the components and keep dry any connectors or other parts that would be damaged if they were to get wet.

Immediately before the probe is installed, the water level in the well will be measured and recorded using other equipment, such as an electronic water level sounder. The transducer will be zeroed, if appropriate. The manufacturer's instructions will be followed to ensure all pre-installation tasks have been performed.

4.4.2 Installation

Proper installation of the down hole pressure transducer probe and the data logger is crucial. A secure and well-known probe placement, together with proper connections to and programming of the data logger, are critical to ensuring high quality water level data are collected and stored.

The depth at which the probe will be positioned will be determined to within 0.01 foot. (If possible, this measurement will be made to within 0.01 foot. However, due to stretching of the cables and tubing, this may not be feasible.) When the unit is ready to be installed, the data logger will be activated and the probe will be lowered slowly down the well. The probe will not be allowed to free fall, as this may damage the transducer and/or strain gauge. When the probe is positioned, a reading will be taken from the probe and recorded on the data logger. The probe's position will gradually stabilize as the cables straighten and stretch from its weight. As the probe's position stabilizes, so will the water level equilibrate to account for the volume of water displaced by the probe. It is recommended that the data logger be programmed to record depths over this stabilization period (generally about an hour, but the manufacturer's instructions should be checked, and up to several hours or more for water level equilibration, depending on the hydrologic setting of the well screen). The frequency at which measurements are made may need to be adjusted to adequately characterize this period, then reset to the frequency desired for long term measurements. For example, if the water level in the well is to be measured once every hour, the frequency should be adjusted to once every five minutes or so until the probe position and water level have stabilized, then reset to once each hour. However, if instructed by the RMRS project manager, collection of these stabilization data may be omitted.

4.4.3 Operation

Unless requested by the RMRS project manager measurement of the total depth of a well will not be made in wells equipped with a down hole water level probe at the same frequency as it is in wells lacking this equipment. To do so will generally require removal of the unit, which is impractical and time consuming, and can result in damage to the equipment.

The data logger has a finite amount of memory storage space. Data will not be allowed to be overwritten or otherwise lost (e.g. due to delay in downloading data or battery failure). Downloading the logger will occur on a regular schedule that allows plenty of extra time for unforeseen problems (such as weather delays) without a loss of data. Unless the logger is recording measurements every five minutes or less it should not be necessary to halt data collection during downloading. The communication cable will be plugged into the computer and the data downloaded according to the manufacturer's instructions. After the data have been downloaded to the computer and downloading has been verified, the data on the logger will be erased and the unit returned to use. This activity will be performed quickly, efficiently, and carefully, so as to ensure that all new data were downloaded and no non-downloaded data are recorded on the data logger and then erased.

The condition of the unit (batteries, desiccant, etc.) will be checked each time the unit is downloaded. If the manufacturer's instructions recommend a more frequent check, these recommendations will be followed. If requested by the RMRS or subcontractor project manager as an additional check, the water level may be measured using other equipment such as an electric sounder (see Subsection 4.3.1) each time this unit is downloaded. If so, the down-hole probe will be minimally disturbed during this procedure. If it is necessary to partially withdraw the unit in order to make the measurement (for example, if the data logger is installed within and blocks access through the well casing), this will be done carefully and efficiently without instructing the unit to pause in its data collection and without kinking the cables and tubing or otherwise damaging or contaminating the withdrawn portion. (Note that even partial withdrawal of the unit will cause the water level to drop somewhat relative to its position prior to this withdrawal.) The withdrawn components will not be allowed to contact potentially contaminated media and will be sheltered from windblown dust and debris, if they do contact these media or become dirty they will be decontaminated according to SOP PRO 127, General Decontamination, and the manufacturer's instructions. Components will be restored to their proper place as quickly and carefully as practicable. A chronological log of these activities and their results will be maintained within the comments section of the Groundwater Level Data from Down-Hole Pressure Transducer form (Form PRO 105B).

If groundwater sampling is to be performed on a well equipped with a down-hole water level probe provisions must be made in advance for storing the probe, cables, tubing, data logger, and associated components during these activities. Depending on the duration of the sampling activities (single or multiple days), the size of the unit, and the quantity of cables and tubing, it may be desirable to store the submersible components in a clean, covered tub filled with deionized or distilled water and the remaining components in a clean plastic bag adjoining the tub. (The manufacturer's instructions will first be consulted to ensure the unit is compatible with the water to be used, as some pieces of equipment are sensitive to deionized water.) Alternatively, the unit may be placed on clean plastic sheeting. If the well dewateres and takes more than one day to complete sampling, the probe and its associated down-hole components will be safely stored in a clean enclosure such as one or more large, heavy-duty plastic bags until sampling has concluded, and will be decontaminated before reinstalled in the well.

Regardless of the method of temporary storage, the components will not be allowed to contact potentially contaminated media and will be sheltered from windblown dust and debris. Data collection from the probe will be halted. Withdrawal of the unit from the well will proceed slowly and carefully, and in accordance with the manufacturer's instructions. All components of the down-hole probe assembly will be visually inspected as they

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- 6 In the blank marked "Checked by" record the initials of the individual who checks the calculation performed in Step 5
- 7 In the "Comments" section note any significant features or activities near the well that could affect the water level. OVM readings or other data recorded on form PRO 105A

In wells equipped with down hole pressure transducers form PRO 105B shall be used. The following information shall be recorded for each observation well site:

- The RFETS Project Number and well number
- The names of personnel downloading the data and performing associated activities
- The equipment manufacturer, model, and serial number
- Results of OVM monitoring
- The date and time of the first and last water level measurements recorded on the data logger
- The number of records downloaded and the frequency of measurement
- The depth of the probe
- Water level and probe datum, if other than MP
- Battery condition
- The identity of the diskette(s) on which downloaded data were stored
- Whether the water level was checked using other means, and if so, the results of this measurement
- Comments on any unusual conditions that may relate to these data, as appropriate
- The name of the QC reviewer and the date of the QC review

Water level data downloaded from wells equipped with down hole pressure transducers and data loggers will be archived electronically in their original form without conversion or other data manipulation. If conversion is necessary to render the data useable, converted data shall be archived separately and an explanation of the conversions shall be included. Data diskettes (original and converted forms) will be transmitted to the RMRS project manager on the same schedule as data from wells without down hole probes unless this individual requests otherwise. Copies of the data diskettes will also be stored by the subcontractor. Summary hydrographs will also be provided to the RMRS project manager and will display water level depth and topographic elevation versus time. Hard copies of the data shall not be provided unless the RMRS project manager requests them.

7.0 REFERENCES

7.1 Source References

The following references were reviewed before this procedure was written:

Freeze, R. Allen, and John A. Cherry, 1977, *Groundwater*, Prentice Hall, Inc., Englewood Cliffs, NJ.

U.S. Department of Energy (DOE), August 1987, *The Environmental Survey Manual*, Volumes 1-4, DOE/EH-0053.

U.S. Department of Interior, Water Resources Division, 1977, *National Handbook of Recommended Methods for Water-Data Acquisition*.

U.S. Environmental Protection Agency (EPA), September 1986, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, OSWER 9950-1.

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U S Environmental Protection Agency December 1987 *A Compendium of Superfund Field Operations Methods*
EPA/540/P 87/001

U S Environmental Protection Agency (EPA) October 1988 *Guidance for Conducting Remedial Investigations
and Feasibility Studies Under CERCLA Interim Final*

U S Environmental Protection Agency (EPA) May 1989 *RCRA Facility Investigation Guidance Interim Final*

7.2 Internal References

Related SOPs cross-referenced by this SOP are as follows

- SOP RMRS/OPS-PRO 127 General Equipment Decontamination
- SOP FO 15 Photoionization Detectors (PIDs) and Flame Ionization Detectors (FIDs)
- SOP RMRS/OPS-PRO 113 Groundwater Sampling

are withdrawn. Any necessary cleaning or repairs (for example removing accumulated sediments from the probe) will be performed following the manufacturer's instructions and/or SOP PRO 127 General Equipment Decontamination. The well will then be sampled as per SOP PRO 113 Groundwater Sampling. After sampling has concluded and the down hole probe is reinstalled, data collection will be reactivated.

General maintenance will be performed as recommended by the manufacturer. Routine maintenance may include replacing the desiccant, cleaning the filter at the pressure transducer, clearing the ports at the pressure transducer, replacing the batteries, recalibrating the probe, and general cleaning and checking of components and connections. Depending on the unit, many of these tasks may only be performed by the manufacturer. If necessary, the unit will be removed from the well, decontaminated, and returned to the manufacturer for service.

Computer connectors will be handled carefully and used properly. Some probes have specially designed connector caps or storage that adequately addresses potential moisture problems. If this is not the case with the connector being used, it will be kept dry by storing it in a plastic bag within the wellhead. If condensation is a problem, a packet of desiccant may be kept in the bag, unless the manufacturer's instructions specify other alternatives.

4.5 Decontamination

Methods used to prevent cross contamination include scheduling activities to proceed from locations with potentially lesser to those with potentially greater levels of contamination, and thorough decontamination of all materials contacted by potentially contaminated media. Water level measurement equipment and the personnel who use them are decontaminated for the dual purposes of minimizing cross contamination and providing a safe and healthy working environment.

Equipment should be constructed of stainless steel, PTFE, or other inert materials that have been approved by RMRS. Equipment will be decontaminated before and after use at each well.

If freshly decontaminated equipment is kept clean during transport to the next well by being stored in a clean plastic bag, clean plastic wrap, or clean equipment storage case, the need for repeated decontamination prior to using the equipment at that next well may be eliminated. In such cases, the equipment need only be decontaminated immediately following use at each well. Procedures for decontamination are set forth in the site specific health and safety plan and SOP PRO 127 General Equipment Decontamination.

5.0 QUALITY ASSURANCE / QUALITY CONTROL

The frequency of measurements and the accuracy desired in measuring changes in water levels depends on the objectives established in the Work Plan or the Sampling and Analysis Plan for a given project. All appropriate data will be recorded on a Groundwater Level Measurements/Calculations form (Form PRO 105A) or Groundwater Level Data from Down Hole Pressure Transducer form (Form PRO 105B) before leaving the well site.

Electronic water level sounders will be calibrated quarterly by following the manufacturer's instructions or by suspending the sounder and measuring it against a calibrated steel tape if no other calibration instructions are supplied. Down hole water level probes will be calibrated by the methods and frequency recommended by the manufacturer and the results documented on a log sheet kept on file in the groundwater monitoring field office.

6.0 RECORDS

A permanent record of the implementation of this SOP will be kept by documenting field observations and data in black waterproof ink on a Groundwater Level Measurements/Calculations form (Form PRO 105A). If the well is

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equipped with a down-hole water level probe the appropriate observations and data will be recorded on a Groundwater Level Data from Down-Hole Pressure Transducer form (Form PRO 105B)

When measuring with tools other than a down hole pressure transducer the following information should be recorded for each observation-well site

- The RFETS Project Number and well number
- The date and time of the water level measurements
- The names of personnel performing the measurements
- The equipment manufacturer model and serial number
- Results of OVM monitoring
- Depth to water and total depth of well, both relative to MP
- The perceived condition of the bottom of the well (soft vs hard)
- Comments on any unusual conditions that may relate to these data, as appropriate
- The name of the QC reviewer and the date of the QC review

Individual measurements are entered onto the Groundwater Level Measurements/Calculations form (Form PRO 105A) as the measurements are performed. The information is recorded as follows:

- 1 Record well number in the first column
- 2 Measure and record the depth to water from the measuring point in the second column (WD). The measurement will be taken twice or more if measurements are difficult to obtain. Measurements from the two readings must agree within 0.01 foot. If the measurements do not agree within 0.01 foot, a second individual may attempt the measurement. Continue to measure until the reason for the lack of agreement is determined or until two consecutive readings are shown to agree within 0.01 foot, or 0.05 foot if the measurements are made by two individuals. An average of the reproducible readings will be utilized for the determination of the water level.
- 3 Measure the total depth of the well from the MP and record this value in column three (MTD). The measurement will be taken twice. Measurements from the two readings must agree within 0.01 foot. If the two measurements do not agree within 0.01 foot, continue to measure until the reason for the lack of agreement is determined or until two consecutive readings are shown to agree within 0.01 foot (0.05 foot if made by two individuals). An average of the reproducible readings will be utilized for the determination of the total depth.
- 4 In some devices the length of the probe end may not have been taken into consideration when the measuring tape was marked. In this case the length of the probe end will need to be added to the measured total depth in order to determine the total depth of the well from the MP. Record the length of the probe end in column four (Probe end).
- 5 Determine the total depth of the well from the measuring point by adding the length of the probe end to the measured total depth from the MP and record this value in column four (TD). Total depths of wells may be measured monthly, quarterly, or as instructed by the RMRS project manager.

WATER LEVEL MEASUREMENTS IN WELLS
AND PIEZOMETERS

Procedure NO RMRS OPS PRO 105

Revision

Effective Date 12/28/98

Page 1 of 1

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
Form PRO 105A
GROUND WATER LEVELS
MEASUREMENTS / CALCULATIONS

ROCKY FLATS PROJECT

EQUIPMENT MANUFACTURER

PROJECT NO

MODEL

DATE

SERIAL NO

PERSONEL (1)

CALIBRATION DATE PASSED

DATE DUE

(2)

QC REVIEW NAME

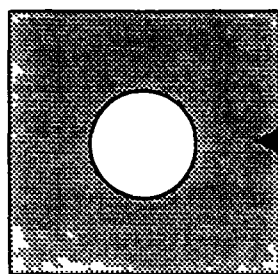
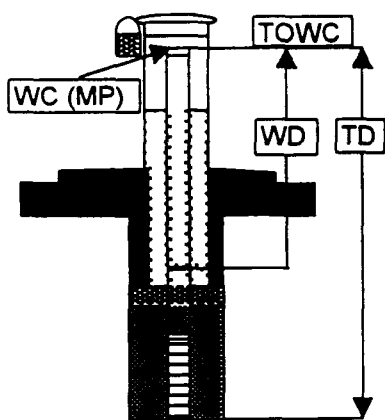
DATE

☐ Quarterly

☐ Monthly

☐ Special

WELL NO			Comments			MINI RAE
	WD	MTD	Background	Headspace	Well Bore	
MEASUREMENT 1						
MEASUREMENT 2						
TIME						
	AVERAGE WD	AVERAGE MTD	PROBE END	TD	CHK'D BY	



TOP VIEW
WELL PAD



WELL
PROTECTIVE
CASING

END VIEW OF
WELL PAD

COMMENTS

SIGNATURE

DATE

FOOTNOTES

TOWC=TOP OF WELL CASING

WD = DEPTH OF WATER FROM MP

MTD = MEASURED TOTAL DEPTH FROM MP

PROBE END = LENGTH BEYOND MEASURING POINT OF PROBE

TD = DEPTH OF BOTTOM OF WELL FROM MP

NOTES

ALL MEASUREMENTS ARE MADE IN FEET RELATIVE TO MARK POINT (MP) = N SIDE OF TOWC

QC REVIEW BY SUPERVISOR IS A CHECK OF REASONABLENESS

MEASUREMENTS 1 AND 2 MUST BE WITHIN 0.05 FT

